

Benefiting from energy-saving luminophores technology in designing sustainable luminous outdoor ads

Dr. Dena, M. Hanna

Faculty of Applied Arts, Advertising Department, Damietta University, Egypt, doodyamh@gmail.com

Abstract:

At a time when the world is living on the impact of a major energy crisis, and the threats of gas interruption, Egypt was able within a few years to establish various sources of electricity generation, but despite that, scientific efforts continue to reach and make optimal use of renewable energy sources, which is the motive that drives the whole world to obtain clean energies and replace non-renewable energies with clean and environmentally friendly ones. Although the idea is not new, implementing it with local materials makes the implementation of this innovation affordable, especially in a country that is trying to advance economically by rationalizing its resources and using them optimally in order to enhance safety on the streets and highways. There is no doubt that advertising should participate in all areas of life, even in technological developments, inventions and various innovations. This research paper seeks to promote and integrate advertising with environmentally friendly technology to save energy consumption through street lighting with advertisements as a kind of renewal and development in quality and method instead of traditional advertising, which in turn will help reduce energy consumption, increase promotion and advertising environmental awareness among all the audience and advertisers at the same time. Some examples were discussed and clarified about the use of luminous luminophores in advertising, rationalization of electricity consumption and lighting poles and roads, in addition to making an applied part as some hypothetical examples of the form of advertising with this technology. This paper follows the descriptive approach in collecting theoretical information related to technology and its role in transforming outdoor advertisements into giant advertising systems for street lighting, followed by a presentation of some global luminous concrete models that used this innovative technology in some other fields.

Keywords:

Luminophores, Sustainable Ads, Luminous Graffiti Ads, Luminous Concrete, Energy Saving.

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Introduction

Today we live in an era of excitement and suspense, as remarkable progress towards reducing dependence on fossil fuels as an energy source has become a top priority. Several studies have predicted that the shift towards electric cars will have a significant impact on the amount of gasoline that the world consumes over the next few decades. At the same time, great strides are being made in other areas. For example, the fields of windmills are becoming more widespread and more efficient, and the great advances in knowledge and at the present time have been able to double the energy produced by solar panels.

On the other hand, technological development has been able to employ phosphorous materials to lead us to reduce our dependence on fossil fuel energy. One of the most exciting examples is mixing cement with glow-in-the-dark materials to use for lighting driveways and walkways. ⁽²⁾

The field of advertising can benefit from this creative luminous concrete technology in many fields of advertising to consume light energy, such as lighting pavements with ads and logos, rationalization of energy consumption in lighting advertisements, creating a distinct advertising atmosphere for products and brands, attract the recipient's attention when seeing these types of

bright ads.

Statement of the Problem:

The present study mainly tried to answer the subsequent questions:

- Q1:** How can advertising benefit from luminophores technology?
- Q2:** To how extinct will luminophores be effective in beautifying, lighting environment, and attracting recipient's attention?
- Q3:** Does the use of this technology in advertising really help reduce the use of electrical energy by some advertisements at night?

Objectives

This study aims to:

1. Increase advertising environmental awareness through the optimal use of modern technologies and techniques that can be applied in the field of advertising.
2. Find some innovative solutions for lighting roads and external surfaces using solar energy and innovative environmentally friendly advertising by integrating advertising with innovative sustainable technologies.

Importance

This study is concerned with activating and expanding the role of outdoor advertising, by integrating advertising and employing it using

modern technologies such as luminous concrete technology in street lighting and reducing electricity consumption at night by making illuminated advertisements with this technology aimed at promoting either products or services, and drawing attention for recipients in a different, unconventional way.

Hypothesis

Two potential underlying hypothesis are going to be discussed:

H1: Employing luminophores technology in advertising will improve the application of external advertising and contribute to change the world towards a clean and sustainable environment.

H2: Replacing the old and traditional outdoor advertisements that consume electrical energy in lighting at night with sustainable ones using luminous concrete if the advertisement is suitable for that change.

Theoretical Framework:

The idea of luminous concrete, luminous or phosphorous cement is not new, but rather it is the product of great research that was widely recognized at the beginning of 2016 by a research team led by "José Carlos and Rubio Avalos", researchers at the University of Michoacan in San Nicolás de Hidalgo in Mexico, where they were able to produce a new type of phosphorous cement that could light highways, bike paths, or buildings without using electricity. ⁽³⁾

This innovation changed the standards by transforming the opaque cement into a luminous cement by modifying the internal composition of the cement, which resulted in a material that allows absorbing ultraviolet rays from light sources and returning it in the form of a glow in the dark that illuminates its surroundings.

It is clear that the luminous cement would mean the end of the world of road lighting poles, which means that the street itself would light the way for passers, recipients and motorists, which in turn would save electrical energy at the global level. The phosphorous in the cement absorbs sunlight, direct and indirect, all the ultraviolet rays of the sun in the day, then releases it in the evening again in the form of light. After the end of the day, and the absence of sun, the street can shine with light for a full 12 hours.

Phosphorous cement is not different from ordinary cement, because it is a powder to which water is added, and it turns into a gelatinous mass that gradually hardens, but it is more durable.

The "Scientific American" website commented on this in 2016 saying: "By using additives, scientists were able to prevent the formation of crystals that form naturally during the cement production

process, creating a substance in a state similar to glass that allows light to pass into it, and that changing the percentage of additives added during the cement manufacturing process regulates both the intensity and color of the lighting, so that the intensity of the lighting does not cause drivers to be distracted when using the mixture on the roads". ⁽³⁾

Earlier, Carmen Andrade, a researcher at the Spanish National Council's (CSIC) "Building Sciences Institute in Madrid", said, "It is an application that could be worth developing in countries and regions with poor access to electricity in communities with poor standards of living, pointing out that "cement is a very alkaline substance, so it is necessary to study the stability of these compounds, and how to repair them." ⁽³⁾

Luminophore

- A luminophore (sometimes shortened to lumophore) is an atom or functional group in a chemical compound that is responsible for its luminescent properties. ⁽⁴⁾
- Luminophores can be either organic or inorganic. ⁽⁵⁾
- Luminophores can be further classified as fluorophores or phosphors, depending on the nature of the excited state responsible for the emission of photons. However, some luminophores cannot be classified as being exclusively fluorophores or phosphors ⁽⁶⁾

Preparing light emitting cement:

The method of synthesizing a light emitting concrete structure comprises preparing slurry. The slurry is prepared by mixing sand, gravel, cement and water. Further, a light emitting pigment mixture is prepared. This light emitting pigment mixture is prepared by mixing a titanium powder, resins and a Sulphide powder. ⁽⁷⁾

Glowing concrete:

Sparkling cement is the one which can get the sun based or counterfeit light energy during daytime and convert it into noticeable light in evening time. Shining cement is also called light discharging cement or Glow in obscurity concrete. ⁽⁸⁾

Glow in the dark concrete works by adding phosphorescent crystals into the concrete surface. These crystals absorb daylight, which is then emitted for most of the night. During the day, the concrete looks white. At night, it glows green or blue, depending on the aggregates used. ⁽⁹⁾

Concreters have come up with yet another ingenious use of the material in the modern surrounding. Glow in the dark concrete is trending, giving more options for creative concrete advertising, outdoors creations, driveway ideas and other uses in and around. ⁽¹⁰⁾



Figure (1) luminescence technology that gives materials, especially concrete, technical and decorative properties.

Glowing concrete uses:

Glowing concrete can be played with inside and outside the home. It all started with pavers, and since then many manufacturers have come up with similar illuminating products.

- As well as pavers, illuminating concrete can be used for:
 - Driveways
 - Walkways
 - Stairs
 - Garden beds
 - Water features
 - Pool decks
 - Bench tops
 - Indoor flooring

Luminophores (glowing concrete) can be used in advertising as it comes up with all sorts of creative and wonderful patterns and shapes by mixing and matching colors and sizes. As advertisements depends in the first place on creative, attractive and innovative ways. Therefore using such luminated structures in ads would make an impact or simply illuminate a specific area. Which will reflect its role

on viewers and passers-by on the roads towards advertising and the new technology applied in advertising.⁽¹¹⁾

Stones glowing time

Just 30 minutes in the sun can give glow stones enough charge to light up for 8 hours. Glow stones in illuminating concrete can last for 15 years or more, depending on their quality.

Dark sand glowing time

Glow in the dark sand particles can emit light for 8 to 12 hours, though the intensity of the light will fade over time.

The method of glowing stones in the dark

Crystals in illuminated concrete include photo luminescent compounds. These absorb sunlight and emit it once the light level drops. These stones are strong enough to be incorporated into a glow in the dark concrete driveway

Aggregate used in concrete

Aggregates are any solid material incorporated in a concrete mix. As well as glow stones, concrete can include sand, gravel, pebbles and other crushed stone.

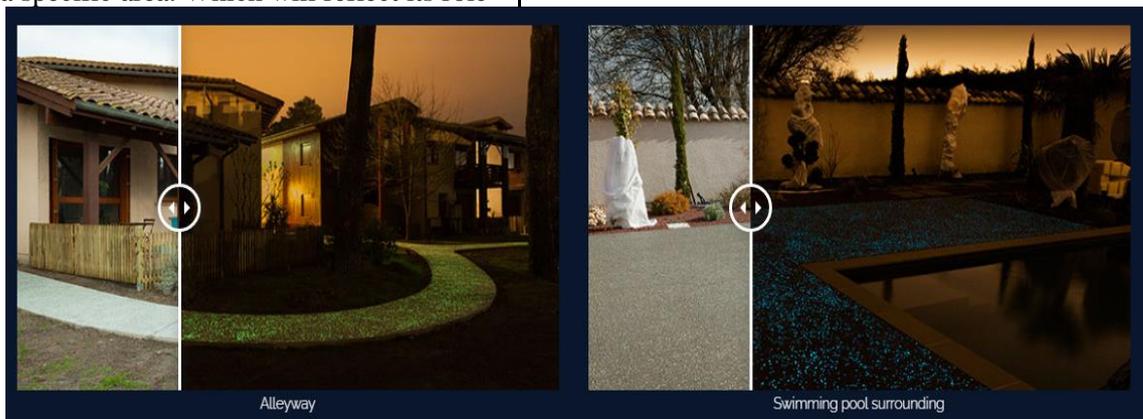


Figure (2) Although it is manufactured like ordinary cement, the change in the microscopic structure needed to make it glow modifies the structural properties of the material - thus it may not have the same applications as the ordinary kind, and is intended to be used on surfaces as a coating material.

Because of the inorganic nature of the cement components, the material can have a very long shelf life when compared with other phosphorescent materials such as plastics or paints - but this will always depend on how it is used.

Phosphorescent materials absorb energy from radiation such as the ultraviolet light emitted by the

sun - or by lamps, if indoors. Energy is later emitted as light, which can be seen after dark. As it loads up energetically with ultraviolet rays, even on cloudy days the cement will be able to absorb enough energy to glow during dark periods for up to 12 hours.⁽¹²⁾



Figure (3) A bicycle lane inspired in Van Gogh's *Starry Night* can be found in the Netherlands. It was built using phosphorescent tiles

6-9- Decorative usages of luminophores in advertising: ⁽¹³⁾

6-9-1- Unique aesthetic and chromatic qualities

- Different visual effects in the light and dark.
- A choice of day-time colours that are different from the colours visible at night
- Day-time colours that imitate natural aggregates.



Figure (4) The effective glow is thanks to a special "ingredient".

The above project is a joint venture between the TPA Quality Assurance laboratories in "Pruszków/PL", where research has been going on for a long time on colour and light-reflecting asphalt, and the European construction company "Strabag". The goal is to enhance the safety of cyclists by providing aesthetic, economical and environment friendly solutions. Luminophores, the luminescent particles used in the asphalt material, may have different colours. Here blue was selected as the colour that best suits the picturesque landscape, and for visibility reasons after dark. The colour combinations yellow-green and green-blue, as well as the colour blue itself, have strong luminescent properties ⁽¹⁴⁾

At the same time, the blue colour appears brighter to the eye. In the summertime, the construction is able to emit light until dawn. Observations have

6-9-2- An effect on architectural lines

- Horizontally (landscaping concrete, decorative floor...).
- Vertically (building façades...).

6-9-3- Enhanced visibility and quality of life

- Spaces are more clearly defined, making it easier for users to find their way in the dark.

shown: the higher the temperature and brightness of the daylight, the longer and stronger the luminescent effect. The goal is to process the technology using automated techniques in future, which would enable the material to be incorporated evenly and durably while laying the asphalt – and still save costs. ⁽¹⁵⁾

6-10 - Durability of using luminophores or luminous concrete: ⁽¹⁶⁾

6-10-1- Long-lasting material

The material is designed for intensive use and its performances won't deteriorate over time.

6-10-2- Energy efficient

Can in some cases replace electric lighting at night or lowlight.

6-10-3- Environmentally friendly

Composite products made using recycled materials.



Figure (5)

6-11- Effectiveness of luminophores: ⁽¹⁷⁾

6-11-1- Excellent glow time (more than 10 hours).

6-11-2- Good resistance to



- Breakage due to impact.
- Friction wear.
- Freeze-thaw cycles.

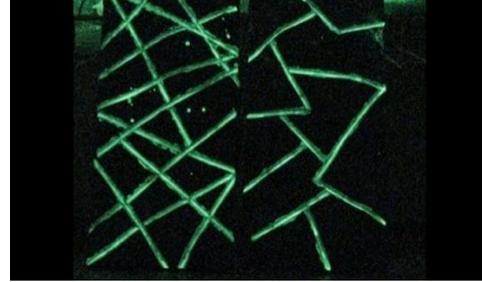


Figure (6)

6-12- Advantages of its usage: ⁽¹⁸⁾**6-12-1- Easy to place and maintain**

Uses the same production process as for decorative concrete.

6-12-2- No additional maintenance costs

Luminous concrete is maintained just like conventional decorative concrete.

6-12-3- Autonomous process

Energy absorption and emission cycles alternate without external intervention.



Figure (7)

6-13- Luminophores applications: ⁽¹⁹⁾

- Garden paths and walkways.
- Terraces.
- Swimming pool surrounding.

- Pavements, cycle paths and unlit roundabouts.
- Exposed aggregate and polished concrete.

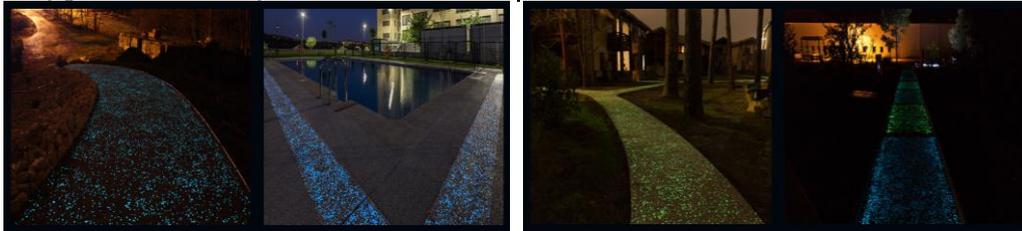


Figure (8) Alleyway to a private home – France, Swimming pool surrounding – Spain, Residential alleyway – France, Path leading to a plant – France

7- Research methodology

The research is exploratory and descriptive in nature. Observational, and critical writing is adopted, in collecting theoretical information associated with benefiting from energy-saving luminophores technology in designing sustainable luminous outdoor ads followed by presenting some models and examples created in that field that can be used and applied in advertising.

Some benefits of this new technology have been illustrated with an explanation of the method of usage and features in preparation for their application in the field of advertising and external trademarks in streets and squares.

This research also includes the analytical part and a questionnaire about the possibility of

applying this technology in Egypt, Egyptian streets and squares with the development of Egypt's 2030 vision of saving electricity, energy consumption, developing streets, sidewalks, and creating special paths for bicycles, which can be exploited by bright advertisements, whether service or commercial advertisements, or even with the aim of stimulating tourism or any other field that rises up the country.

7-1- Introduction about the problem

Egypt has recently been striving for a renaissance in everything, whether at the social, economic, political levels, and at all levels, in order to compete with the global market and fiercely while maintaining security and stability. Advertising played many roles in previous periods in supporting the state's direction of

revitalizing tourism, combating the Corona epidemic and increasing popular awareness. Therefore, the advertisement must complete its special role in beautifying the environment and work in parallel with the state's plan to rationalize energy consumption and activate the concept of environmental sustainability. Therefore, the researcher seeks in this research paper to transform the form of advertising from lit with electric energy to luminous ads with solar energy by employing luminous concrete in advertisements that allow it to be applied

whether on the roads, in the streets, or in gardens and parks.

Some hypothetical application models have been made for the form of advertisements that can be applied using luminous concrete in advertisements and display them in some scattered places.

7-1-1- The first advertising model:

A virtual application of the word "Egypt 2030" on the floor of Talaat Harb Square in Cairo for the purpose of beautifying the streets and lighting at night to save energy consumption.



Figure (9)

7-1-2- The second advertising model:

A virtual application of the word "Egypt 2030" on the floor of Tahrir Square in Cairo for the

purpose of beautifying the streets and lighting at night to save energy consumption.



Figure (10)

7-1-3- The third advertising model:

A hypothetical application of the word "Egypt 2030" on the floor of a street in downtown Cairo

for the purpose of beautifying the streets and lighting at night to save energy consumption.



Figure (11)

7-1-4- The fourth advertising model:

A virtual application of the "Adidas" brand with luminous concrete technology in front of a store

for the purpose of beautifying the streets and lighting at night to save energy consumption.



Figure (12)

7-1-5- The fifth advertising model:

A virtual application of the "McDonald's" brand with luminous concrete on a walkway in a garden heading to the store's branch for the

purpose of beautifying the streets, lighting at night to save energy consumption and product advertising



Figure (13)

7-1-6- The sixth advertising model:

A hypothetical application of the "Pepsi" brand with luminous concrete technology in a garden

for the purpose of beautification, lighting and product advertising



Figure (14)

7-1-7- The seventh advertising model:

A virtual application of the "Carrefour" brand with luminous concrete technology in a garden

walk for the purpose of beautification, lighting and advertising the location of the store



Figure (15)

7-2- Recruitment of the participants and sample size:

The selected sample was (100 recipient) who lives and works in Cairo their opinions were taken about the possibility of applying this technology in Egypt. Would they like to see it in the streets of Cairo or

not? Do they think that it is useful and environmentally friendly or not?

15 questionnaires were excluded for their incomplete answers and 85 samples were left valid for analysis as shown in the following table:

Table 1. Sample percentage for the case study.

	Distributed questionnaires	Returned questionnaires	Excluded questionnaires	Analysis questionnaires
No.	100	75	25	75
Per.	100%	75%	25%	75%

The questionnaire form was designed to measure the response of the consumer towards using

luminophores lighting concrete in advertising.

Table 2. Results of questionnaire related to statistical analysis for case study

	Elements of designing questionnaire	T. Agree (%)	Agree (%)	Disagree (%)
1	Have you ever heard of luminous technology	10%	15%	75%

	or luminous concrete?			
2	Do you think that this technique can be applied in Egypt?	86%	4%	10%
3	Is street lighting at night sufficient and satisfactory for you in the streets of Cairo?	13%	15%	72%
4	Would you like to see luminous advertisements with this technology on the sidewalks and designated places illuminated for pedestrians and cyclists?	90%	5%	5%
5	Do you think that advertising in Egypt has a role in resolving crises and increasing environmental distress in the Egypt 2030 plan?	93%	2%	5%
6	Do you think that an advertisement illuminated by concrete that glows at night may be pleasing to the eye and attract the eyes of passers-by?	87%	3%	10%
7	Do you appreciate the role of the government, organizations and advertising agencies in the last few years working on beautifying the countries?	89%	10%	1%
8	Do you think that the use of the advertisement illuminated by luminophore technology can be applied in parks, gardens, streets and squares?	97%	1%	2%
9	Are you one of the people who encourage environmental sustainability and preserve the environment?	90%	5%	5%
10	If the luminous advertisements are implemented in the streets using luminous concrete, do you think that it will help in lighting the streets and give an aesthetic and civilized look to the place?	87%	5%	8%

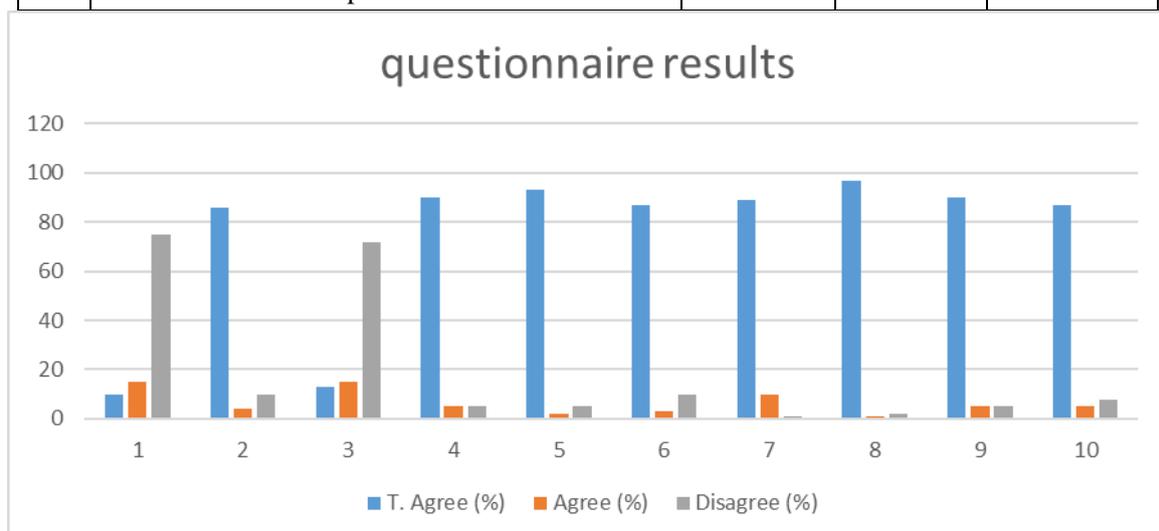


Figure (16)

7-3- Questionnaire results estimated from the above table results showed that:

The result of the questionnaire was in line with the research hypotheses and objectives, as the following results were drawn, as follows:

- 1- Only 25% of those who have heard of the luminous luminophore technology or the luminous concrete, because it is not a technology or technology that is widespread in Egypt in general, so those who have heard about

it are those who go to Europe and other countries where this has already been seen.

- 2- The largest percentage (90%), after getting acquainted with the technology, agreed on the possibility of applying it in Egypt, because there are many new places and cities in which implementation is appropriate.
- 3- The largest percentage, which is 72%, agreed that the lighting in the streets of Egypt is not sufficient and unsatisfactory, especially at night and in the late night hours, and that they need additional lighting.
- 4- 95% of those surveyed want to see illuminated advertisements using luminous luminophores in the streets, on the roads, and in places of pedestrians and cyclists.
- 5- 95% of those surveyed acknowledged that there was an effective role for advertising in eliminating environmental disasters, and that advertising had a significant role and impact in raising awareness, especially starting from the events of Corona until the development plan for Egypt.
- 6- The largest percentage, 90%, believes that advertisements illuminated with this technology will attract attention and attract the attention of passers-by across the roads.
- 7- 99% of those who answered the questionnaire acknowledge the effective role played by governments, organizations and advertising agencies in previous periods for the purpose of beautifying cities.
- 8- The individuals who took the questionnaire were asked, do you think that this technology can actually be applied in gardens, streets, and parks, because most of them did not have knowledge of the technology, so it was important to ask them about their perception after understanding the technology in a simplified manner through examples, and the answer was yes, by 98%
- 9- 95% of the sample that was surveyed is from the environmentally friendly sample and encourages environmental sustainability and the preservation of the environment and nature.
- 10 - 92% of the sample that was surveyed believes that if advertisements are applied in this bright way, then it will help to light the streets and give a civilized life to places.

8- General conclusion and discussion:

The result of the questionnaire was satisfactory for the researcher and for the sample that was surveyed. The largest percentage and the majority, after understanding the technology, luminophores and luminous concrete, and how to apply it through advertisement in easy and simplified ways in streets, gardens, parks and

squares, will give an organized and luminous character to the city and will help increase lighting and possibly reduce the cost Energy and lighting in the streets at night, in addition to the aesthetic character that will be given to the implementation of advertisements in this way that attracts attention and draws the attention of passers-by at night, as it is considered a mutual benefit between advertising and the environment and encourages environmental sustainability in line with the state's commitment to sustainable development Egypt 2030.

9- General Results

- 1- Trying to look forward to different new technologies in the field of advertising and outside the field of advertising in order to get the greatest benefit from everything that surrounds us in the service of advertising.
- 2- Advertising works in an integrated manner with other areas of life, so there must be integration to maximize benefits in all fields and look forward to a better life.
- 3- Advertising environmental awareness has increased through the optimal use of modern technologies and techniques that can be applied in the field of advertising.
- 4- Employing luminophores technology in advertising will improve the application of external advertising and contribute to change the world towards a clean and sustainable environment.

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